

AD-A172 971

A SURGICAL PROCEDURE FOR THE CHRONIC CANNULATION OF THE
CAROTID ARTERY AND THE JUGULAR VEIN IN DOGS(U) DEFENCE
RESEARCH ESTABLISHMENT OTTAWA (ONTARIO)

1/1

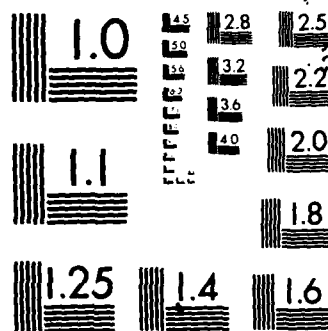
UNCLASSIFIED

K E LEACH ET AL MAY 86 DREC-939

F/G 6/3

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

①



National
Defence

Défense
nationale



AD-A172 971

A SURGICAL PROCEDURE FOR THE CHRONIC CANNULATION OF THE CAROTID ARTERY AND THE JUGULAR VEIN IN DOGS

by

K.E. Leach, L. Prud'homme-Lalonde, R.K. Harding
and M. Bosc-Davie

ORIGINAL FILE COPY

DTIC
SELECTED
OCT 14 1986
S E D
A

DEFENCE RESEARCH ESTABLISHMENT OTTAWA
REPORT NO. 939

Canada

May 1986
Ottawa

86 10 9 021



National
Defence

Défense
nationale

A SURGICAL PROCEDURE FOR THE CHRONIC CANNULATION OF THE CAROTID ARTERY AND THE JUGULAR VEIN IN DOGS

by

K.E. Leach, L. Prud'homme-Lalonde and R.K. Harding
Nuclear Effects Section
Protective Sciences Division

M. Bosc-Davie
Department of Experimental Surgery
Faculty of Health Sciences
University of Ottawa

Accession For	
NIIS GR&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Special
A-1	



DEFENCE RESEARCH ESTABLISHMENT OTTAWA
REPORT NO. 939

PCN
051LA13

May 1986
Ottawa

This document has been approved
for publication and distribution
by the Defence Research Establishment Ottawa

ABSTRACT

A surgical procedure has been developed for the implantation of chronic cannulae in the carotid artery and the jugular vein. The method is simple to perform and allows serial blood samples to be drawn. Infusions of various drugs may be done at the same time as blood pressure recordings on conscious, free-moving or lightly restrained dogs.

RÉSUMÉ

Une méthode chirurgicale pour l'implantation de canules dans l'artère carotide et dans la veine jugulaire a été développée. Cette méthode est facile à exécuter et permet l'échantillonnage de sang et l'infusion de différents composés tout en enregistrant la pression artérielle sur des chiens conscients, mobiles ou légèrement restreints.

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT/RESUME	(iii)
TABLE OF CONTENTS	(v)
INTRODUCTION	1
MATERIALS AND METHODS	2
FIGURE 1	3
FIGURE 2	5
FIGURE 3	7
RESULTS AND DISCUSSION	8
ACKNOWLEDGEMENTS	8
REFERENCES	8

INTRODUCTION

Physiological studies in dogs often require the ability to record blood pressure, to administer various drugs and chemical agents via an arterial cannula and to withdraw repeated blood samples for hematological, biochemical and pharmacological studies. The cannulae must be non-restricting to the normal activities of the dog, and accessible for maintenance and performance of experimental procedures. The surgical procedure must be simple and brief to allow for a quick recovery. Our experiments involving the study of nausea and emesis require the implantation of chronic cannulae in the carotid artery and the jugular vein. In methods described by other investigators (1-2), the exteriorized cannulae were wrapped around the neck of the dog and protected with bandage gauze. These methods were not suitable for our study as the dogs are free-moving and there is the ever-present possibility that they might dislodge the cannulae. We have developed a method to permit blood pressure monitoring, arterial administration of drugs and blood sampling in conscious, free-moving or lightly restrained dogs.

MATERIALS AND METHODS

Animals

Adult beagle dogs (Marshall Farms, New York, and Woodlyn Labs, Guelph) of either sex were used and weighed 9-12 kg at time of surgery. They were housed individually, and Purina Dog Chow and tap water were available ad libitum.

Pre-operative Preparation

The dog was fasted overnight. Prior to surgery, the animal was injected with a tranquilizing Pre-Mix solution of atropine (Agri-Vet Pharmaceuticals Limited, Weston) and Innovar-Vet (M.T.C. Pharmaceuticals, Mississauga) i.m.. The animal was intubated and connected to the anaesthetic machine; surgical anaesthesia was maintained using a mixture of oxygen and halothane. A slow intravenous drip of lactated Ringer's was maintained during surgery. The right side of the neck and an area below the right scapula were shaved and washed with antiseptic soap, dried and brushed with an iodine solution. The animal was draped and full sterile technique was observed.

Cannulation of the Jugular Vein

An incision, approximately 6 cm long, was made in the neck. The right jugular vein was exposed by blunt dissection causing little trauma to the surrounding tissue. Two braided umbilical tapes were placed around the vessel, one proximal and one distal, to control bleeding during the insertion of the cannula. A purse-string suture was placed on the outer side of the vein using 6/0 silk (Fig. 1). A small hole was made in the centre of the purse-string with an 18-gauge hypodermic needle, bevel up. A polyvinyl cannula (Canus Plastics Limited, Ottawa; 0.08cm ID, 0.15cm OD, approximately 1m long) was inserted caudally. At this point, the cannula was flushed with a diatrizoate meglumine solution (Hypaque-M 60%, Winthrop Laboratories, Aurora) and its position in the vessel was determined using a fluoroscope (Siemens Siremobil 2). The cannula was then pushed down into the thoracic vena cava, flushed with sterile heparin saline (4U/ml) and then connected to a Statham P23 ID pressure transducer in order to monitor the pressure on a Grass Model 7 Polygraph (Grass Instruments, Mass.). Once an appropriate response was observed, the purse-string suture was tied and a few drops of polymethylmethacrylate adhesive were applied around the site of the cannula entry to secure the knot and buttress the site. Sterile saline was squirted onto the glue to hasten polymerization. The cannula was flushed with sterile heparin saline and sealed with a small stainless steel pin. The jugular vein and the cannula were replaced in the neck and the umbilical tapes removed. The end of the cannula was marked to enable later identification.

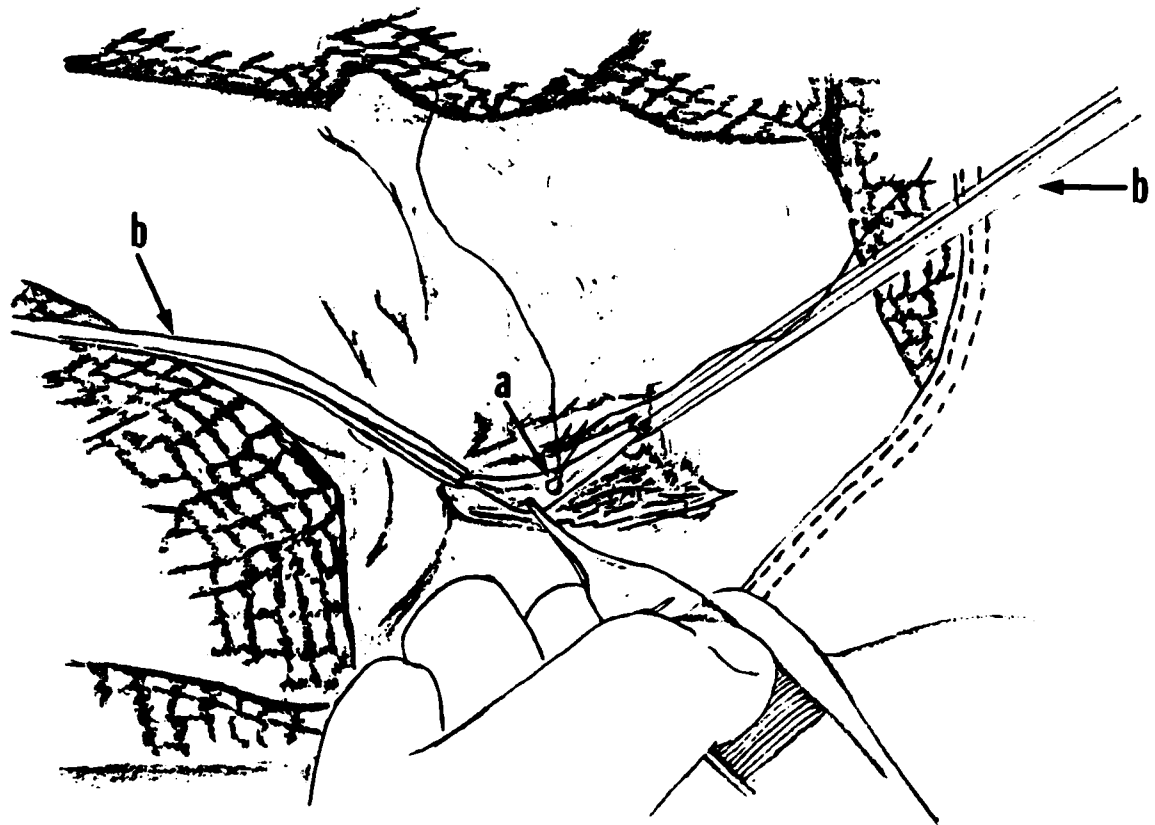


Figure 1: Jugular cannulation showing purse-string suture (a) and umbilical tape (b).

Cannulation of the Carotid Artery

The right carotid artery was exposed by blunt dissection through the same incision site. Once the artery was exposed, the vagus nerve was carefully separated. Two umbilical tapes were placed around the vessel, one proximal and one distal, to provide traction and to elevate the vessel to facilitate cannulation. A small bulldog clamp was placed proximally to occlude blood flow. A purse-string suture was placed as described previously, then a hole was made and the polyvinyl cannula inserted up to the bulldog clamp. The clamp was removed while applying traction on the proximal umbilical tape and the cannula was pushed down into the aortic arch. The purse-string suture was tightened and the position of the cannula was checked and corrected, if necessary, by fluoroscopy; pressure was measured by use of the polygraph, as described previously. The cannula was secured in the same fashion as the jugular cannula. In addition, one 2/0 silk ligature was placed below the purse-string to secure the cannula and occlude the vessel. The cannula was marked for identification and the vessel was returned to its normal position.

Routing of the Cannulae

A small incision was made through the skin on the upper back between the scapulae. A vascular passing instrument (VPI) was tunnelled under the skin, from this entry point to the neck incision. The cannulae were snared with a loop of umbilical tape and drawn through the tunnel using the VPI, taking the cannulae from the neck to the back incision. A small loop of each cannula was left in the neck to allow for movement of the dog's head. The neck incision was closed with 3/0 chromic interrupted suture for the fascia and the subcutaneous layers, and 3/0 Prolene (Ethicon Sutures Limited, Peterborough) subcuticular for the skin. The back incision was closed with 3/0 Prolene subcuticular. Cannulae were wrapped in adhesive tape in a butterfly fashion (about 2x3 cm) and the wings were anchored to the skin with 3/0 Prolene. The jacket (described below) was put on the dog and the cannulae were passed through the mesh of the jacket, placing one in each side-pocket (Fig. 2). Each cannula was connected to a miniature infusion pump (Ealing Scientific Limited, Montreal) weighing approximately 0.5kg which continually infused small volumes (15-20ml/day) of sterile heparin saline (4U/ml) to maintain free-flowing cannulae. The pumps were then stored in the side-pockets of the jacket.

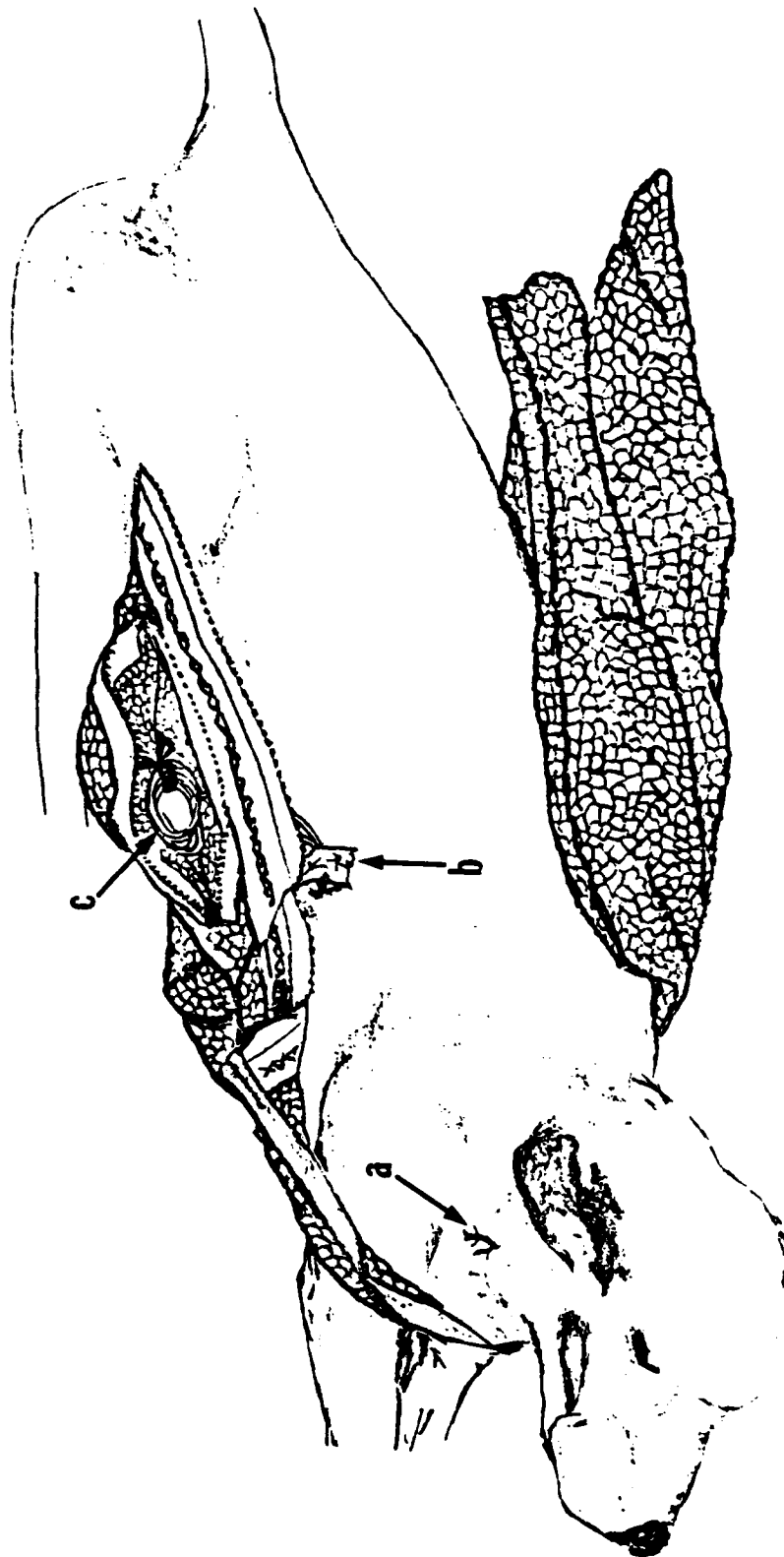


Figure 2: Illustration indicating neck incision (a), butterfly tape (b) and cannulae stored in pocket (c).

Dog Jacket Assembly

A dog jacket (Alice King Chatham Medical Arts, Los Angeles) was used to protect the skin area where the cannulae were exteriorized, as well as to provide pockets in which to store the miniature infusion pumps. The jacket was made of nylon net with two pockets, one on each side. The pockets were 9x18x4 cm with a top-closing zipper 23 cm long (Figure 3). The jacket was closed centre back by a zipper with laces along each side allowing the jacket to be adjusted to fit the dog. A tethering anchor (Alick King Chatham Medical Arts, Los Angeles) was secured to the left side above the scapular region. This provided an attachment point for a flexible metal tether. The jacket was worn continuously and was well tolerated.

Cannula Maintenance

Post-surgery dogs were housed in large individual pens in a group room in sight of, but not adjacent to neighbouring animals. The pump casing held a rechargeable battery and a 60-ml drug reservoir bag and tubing set (Ealing Scientific Limited, Montreal). Every second day, the bags were refilled with sterile heparin saline, and the batteries were recharged as required.

Pressure Monitoring and Blood Sampling

For short-term studies (up to two hours), the animal was lightly restrained in a modified Pavlov sling. The ends of the cannulae were connected to manifolds (Cobe Industries Incorporated, Scarborough) fitted with valves which continued to provide a non-perturbing flow of heparin saline throughout the experiment. The valves provided attachments for pressure transducers which were connected to a Grass polygraph producing recordings of arterial, mean arterial and venous pressures, as well as heart rate. The manifold also permitted blood draws and bolus injections of drugs and various chemical agents. The three-way valves permitted intra-arterial infusions (rate of 0.1 ml/min) while at the same time still recording the arterial pressure with no effect on the level of the pressure recorded.

For long-term studies (up to six hours), the cannulae were routed through the tethering anchor mentioned above. The cannulae were connected to a swivel using two sterile Cordis #7 cannulae (Dimension Laboratories, Mississauga) threaded through the 1-meter flexible metal tether. This set-up permitted the animal to turn at will and protected the cannulae. The animal was housed in a 1x2 metre enclosure and a hinged boom was secured to a side wall above the animal. When the swivel was attached to this boom, it moved in an arc, allowing the animal to move freely and lie down at will. The swivel was connected to the previously described manifold. The same procedures as described above were carried out to allow longer term recordings.

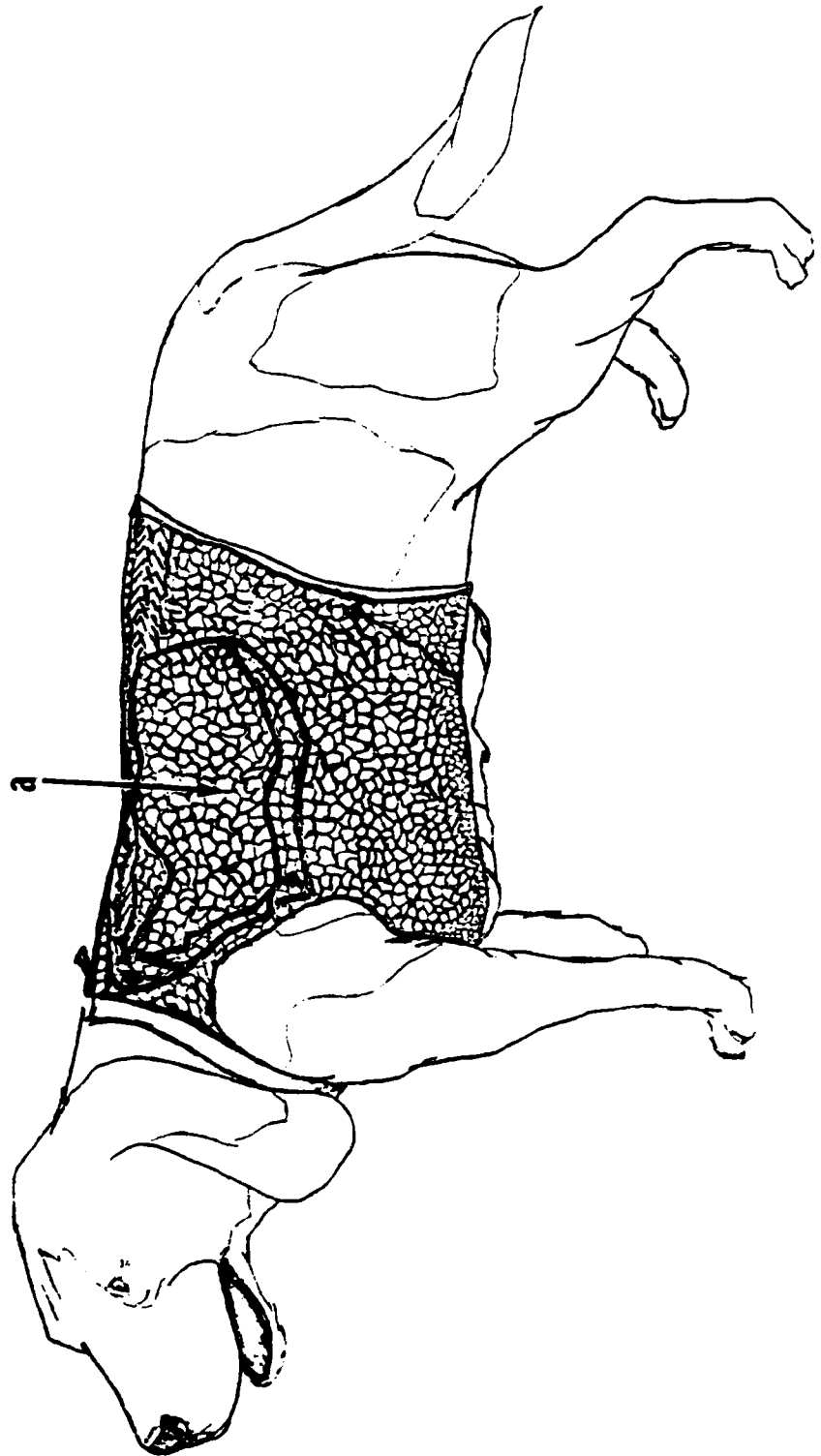


Figure 3: Dog jacket assembly with pockets (a).

RESULTS AND DISCUSSIONS

These techniques have proved to be successful and cannulae have remained functional for a period of four weeks. Some problems and suggested solutions are discussed below.

To date, 11 dogs have been cannulated. The first five dogs were not connected to pumps; the cannulae were flushed daily with sterile heparin saline but this flushing once a day was not sufficient to prevent clotting in the cannulae. In the next six dogs, the use of the miniature mobile infusion pumps was initiated to continually flush the cannulae with minute volumes of sterile heparin saline. This modification has more than doubled the functional life of the cannulae.

The mobile infusion pumps provide the ability to continually infuse various drugs in small doses over a prolonged period of time.

Because the animal was free-moving, the cannulae gradually worked their way out of the vessels, rendering them useless. A modification to the method (3) will soon be introduced, involving the use of perivascular muffs to anchor the cannulae more securely. This will hopefully extend the useful life of the cannula. In the three cases where this problem occurred, no morbidity or mortality was observed.

ACKNOWLEDGEMENTS

The authors wish to thank the Animal Care Service for their expertise in anaesthesia and post-operative care, Mr. James Peeke for performing the hematological examinations and Mr. Alex Saikley for his excellent illustrations.

REFERENCES

1. C. Soles, K.M. Giacomini, S.M. Roberts, et al. A convenient method for repetitive blood sampling in the dog. J. Pharmacol. Meth. 1, 259 (1978).
2. J. Mitala, S.R. Erickson, Method for repetitive blood sampling in the dog: a modification. J. Pharmacol. Meth. 5, 175 (1981).
3. N.P. Hai, Technical notes on long-term vascular access for more than 12 months in conscious dogs. J. Pharmacol. Meth. 7, 57 (1982).

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D		
(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)		
1. ORIGINATING ACTIVITY DEFENCE RESEARCH ESTABLISHMENT OTTAWA Department of National Defence Ottawa, Ontario Canada K1A 074		2a. DOCUMENT SECURITY CLASSIFICATION Unclass
		2b. GROUP
3. DOCUMENT TITLE A surgical procedure for the chronic cannulation of the carotid artery and the jugular vein in dogs.		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) DREO Report		
5. AUTHOR(S) (Last name, first name, middle initial) Leach, K.E., Prud'homme-Lalonde, L., Bosc-Davie, M., Harding, R.K.		
6. DOCUMENT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS 3
8a. PROJECT OR GRANT NO. 051LA 13	9a. ORIGINATOR'S DOCUMENT NUMBER(S) DREO	
8b. CONTRACT NO.	9b. OTHER DOCUMENT NO.(S) (Any other numbers that may be assigned this document)	
10. DISTRIBUTION STATEMENT Unlimited		
11. SUPPLEMENTARY NOTES	12. SPONSORING ACTIVITY DREO/DPM	
13. ABSTRACT A surgical procedure was developed for the implantation of chronic cannulae in the carotid artery and the jugular vein. The method was found to be simple to perform and allowed serial blood samples to be drawn, and infusions of various drugs at the same time as blood pressure recordings to be made on conscious, free-moving or lightly restrained dogs.		

11515

77-065

Unclassified

Security Classification

KEY WORDS

Cannulation - chronic - carotid - jugular - dog

INSTRUCTIONS

1. **ORIGINATING ACTIVITY:** Enter the name and address of the organization issuing the document.
- 2a. **DOCUMENT SECURITY CLASSIFICATION:** Enter the overall security classification of the document including special warning terms whenever applicable.
- 2b. **GROUP:** Enter security reclassification group number. The three groups are defined in Appendix 'M' of the DRB Security Regulations.
3. **DOCUMENT TITLE:** Enter the complete document title in all capital letters. Titles in all cases should be unclassified. If a sufficiently descriptive title cannot be selected without classification, show title classification with the usual one-capital-letter abbreviation in parentheses immediately following the title.
4. **DESCRIPTIVE NOTES:** Enter the category of document, e.g. technical report, technical note or technical letter. If appropriate, enter the type of document, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.
5. **AUTHOR(S):** Enter the name(s) of author(s) as shown on or in the document. Enter last name, first name, middle initial. If military, show rank. The name of the principal author is an absolute minimum requirement.
6. **DOCUMENT DATE:** Enter the date (month, year) of Establishment approval for publication of the document.
- 7a. **TOTAL NUMBER OF PAGES:** The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.
- 7b. **NUMBER OF REFERENCES:** Enter the total number of references cited in the document.
- 8a. **PROJECT OR GRANT NUMBER:** If appropriate, enter the applicable research and development project or grant number under which the document was written.
- 8b. **CONTRACT NUMBER:** If appropriate, enter the applicable number under which the document was written.
- 9a. **ORIGINATOR'S DOCUMENT NUMBER(S):** Enter the official document number by which the document will be identified and controlled by the originating activity. This number must be unique to this document.
- 9b. **OTHER DOCUMENT NUMBER(S):** If the document has been assigned any other document numbers (either by the originator or by the sponsor), also enter this number(s).
10. **DISTRIBUTION STATEMENT:** Enter any limitations on further dissemination of the document, other than those imposed by security classification, using standard statements such as:
 - (1) "Qualified requesters may obtain copies of this document from their defence documentation center."
 - (2) "Announcement and dissemination of this document is not authorized without prior approval from originating activity."
11. **SUPPLEMENTARY NOTES:** Use for additional explanatory notes.
12. **SPONSORING ACTIVITY:** Enter the name of the departmental project office or laboratory sponsoring the research and development. Include address.
13. **ABSTRACT:** Enter an abstract giving a brief and factual summary of the document, even though it may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall end with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (TS), (S), (C), (R), or (U).

The length of the abstract should be limited to 20 single-spaced standard typewritten lines, 7 1/2 inches long.
14. **KEY WORDS:** Key words are technically meaningful terms or short phrases that characterize a document and could be helpful in cataloging the document. Key words should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context.

END

11-86

DTIC